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# REDESCRIPTION OF *OCTOPUS PALLIDUS* (CEPHALOPODA: OCTOPODIDAE) FROM SOUTH-EASTERN AUSTRALIA

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## ABSTRACT

*Octopus pallidus* Hoyle, 1885 from south-eastern Australia is redescribed and illustrated. The species was originally described from specimens collected during the cruise of the H.M.S. "Challenger" (1873–1876) at East Moncoeur Island, off Victoria, and Twofold Bay, New South Wales. *O. pallidus* is now known to be distributed from southern New South Wales to the Great Australian Bight.

*O. pallidus* is readily distinguished from other species of *Octopus* by a number of characters that include: short arms, a broadly ovoid mantle, a distinctive pattern of closely set tubercles and prominent papillae on the dorsum, enlarged suckers on all arms of mature males, a medium-sized ligula (8–16% of third right arm length), large eggs (11–13 mm long), and 7–9 gill lamellae.

*O. pallidus* is an inshore species, living on sand and among sponges and ascidians at depths from 7 to 275 m. The animal is medium-sized; males are mature at approximately 50 mm mantle length, and females attain ovarian maturity at a mantle length of about 60 mm.

Key words: cephalopod; Octopodidae; *Octopus;* systematics; morphology

## INTRODUCTION

The status of *Octopus pallidus* has been confused systematically since Hoyle's (1885a) original diagnosis. This south-eastern Australian taxon has been described under various names, including *O. boscii* Lesueur, 1821 (Brazier, 1892; Pritchard & Gatliff, 1898), *O. variolatus* Blainville, 1826 (Berry, 1918) and *O. boscii* var. *pallida* Hoyle, 1885. To revise and supplement the work of Hoyle (1886), Berry (1918) and Robson (1929), a comprehensive re-evaluation of *O. pallidus* was undertaken, based upon the examination of new material from south-eastern Australia. It should be noted that the validity of records based upon descriptions of specimens from outside Australia (see Joubin, 1897; Hoyle, 1904; and Massy, 1916a,b) is not determined in this study. The counts, measurements and indices listed in Tables 2–5 are as defined by Roper & Voss (1983). Other abbreviations used are: BMNH—British Museum (Natural History), and MV— Museum of Victoria. This paper is the first in a monographic revision of the genus *Octopus* in south-eastern Australian waters.

## HISTORICAL RESUMÉ OF *OCTOPUS PALLIDUS*

Hoyle (1885a) described *Octopus boscii* var. *pallida* based upon specimens collected in south-eastern Australia during the cruise of the H.M.S. "Challenger" (1873–1876). Additional details appeared in a subsequent description (Hoyle, 1885b), which was later expanded with the inclusion of measurements and figures (Hoyle, 1886). The sexes of the specimens and locality details differ in all three papers. Hoyle (1886) listed the correct information. The described material included one male from off East Moncoeur Island, Victoria, and one female and a juvenile from off Twofold Bay, New South Wales. Hoyle (1886) included measurements and figures of the large female specimen (total length of 325 mm), and gave the hectocotylised arm measurements from the male specimen (total length of 160 mm). There were no details of the juvenile. Hoyle (1886) maintained that, rather than erect a new species, he would refer the "Challenger" specimens to *O. boscii* var. *pallida*, comparing it with a specimen of *O. boscii* in the British Museum that had been identified by J. E. Gray. Hoyle was uncertain whether Gray had based his identification

TABLE 1. Material examined: *Octopus pallidus*.

| Sex | ML (mm) | MV reg. | Location | Date | Depth (m) |
|---|---|---|---|---|---|
| 1♀ | 14.3 | F52095 | Western Port Bay, Vic. [39°S, 145°E] | — | — |
| 1♀ | 25.3 | F52094 | 38°00′S, 148°05′E | 14.II .1971 | 44 |
| 1♀ | 26.4 | F31559 | 38°54′S, 147°07′E | 18.XI .1981 | 58 |
| 1♀ | 31.2 | F52093 | Port Lincoln, S.A. [35°S, 136°E] | — | — |
| 1♂ | 43.0 | F30855 | 40°56′S, 146°06′E | 4.II .1981 | 64–68 |
| 1♂ | 54.1 | F52108 | 43°39′S, 147°49′E | 16.II .1976 | 160 |
| 1♂,1♀ | 54.5–60.8 | F52503 | 38°02′S, 145°05′E | 10.X .1984 | — |
| 1♂ | 54.7 | F30872 | 40°27′S, 147°25′E | 6.II .1981 | 55 |
| 1♂ | 56.9 | F24453 | 38°05′S, 145°05′E | 14.XII.1958 | 15 |
| 1♂ | 60.8 | F24499 | Port Melbourne, Vic. [38°S, 145°E] | 29.V .1925 | — |
| 1♂ | 64.8 | F52497 | Bruny Is., Tas. [43°S, 148°E] | II .1972 | 12 |
| 1♀ | 66.2 | F52090 | 32°24′S, 133°24′E | 26.X .1973 | 40 |
| 2♂,2♀ | 69.4–89.7 | F52087 | 39°46′S, 145°34′E | 3.II .1981 | 79 |
| 2♀ | 69.5–70.7 | F30871 | 40°33′S, 145°45′E | 4.II .1981 | 68 |
| 1♀ | 72.5 | F24451 | Mentone, Vic. [38°S, 145°E] | — | — |
| 1♀ | 73.5 | F52502 | 38°02′S, 145°05′E | 29.VII.1985 | — |
| 1♀ | 80.8 | F52505 | Wilson's Promontory, Vic. [39°S, 146°E] | 5.II .1982 | — |
| 2♂,1♀ | 89.4–99.8 | F52506 | Wilson's Promontory, Vic. [39°S, 146°E] | IX .1984 | – |
| 1♀ | 98.0 | F52504 | Bass Strait [40°S, 146°E] | — | — |
| 1♂ | 98.1 | F52499 | 39°08′S, 143°25′E | 31.I .1981 | 55–84 |
| 1♂ | 105.0 | F52500 | 38°02′S, 145°05′E | 12.VII.1984 | — |
| 1♂ | 117.4 | F52507 | 38°02′S, 149°12′E | 16.IX .1984 | 118 |
| 1♂ | 147.3 | F52501 | Stanley, Tas. [40°S, 145°E] | V .1980 | 37 |

upon the description of *boscii* by Lesueur (1821) or Férussac & d'Orbigny (1835–1848), but decided that "it appeared better to accept Gray's opinion and to give a new description of the old species."

Both Brazier (1892) and Pritchard & Gatliff (1898) listed *O. boscii* var. *pallida* Hoyle in synonymy with *O. boscii* Lesueur. Brazier's (1892) listing was based upon Gray (1849), and used existing locality records; Pritchard & Gatliff (1898) added a new record (Port Phillip Heads, Victoria), but no further information was included.

Berry (1918) revised the species' nomenclature and described specimens collected in the waters off Victoria, Tasmania and the south-east of Western Australia by the F.I.S. "Endeavour" (1909–1914). He pointed out that *O. boscii* Lesueur as an indeterminate species could not be accepted, and concluded that if any of the older names were valid, *variolatus* had priority. He included *O. boscii* var. *pallida* in that synonymy. Berry (1918) provided descriptions, measurements and figures of the "Endeavour" specimens, noting particularly the animals' integumental sculpture.

Robson (1929) raised *pallida* to specific rank. He concurred with Berry's (1918) dismissal of *boscii* Lesueur. Robson, however, disagreed with Berry's use of *variolatus* Blainville, explaining that the type specimen of *variolatus* was lost, and that Blainville's type description was ambiguous. Robson (1929)

TABLE 2. Measurements (mm) and indices of 10 female *Octopus pallidus*.

| | F52095 | F52094 | F31559 | F52093 | F52090 | F30871 | F30871 | F24451 | F52087 | F52087 |
|---|---|---|---|---|---|---|---|---|---|---|
| ML | 14.3 | 25.3 | 26.4 | 31.2 | 66.2 | 69.5 | 70.7 | 72.5 | 73.7 | 86.4 |
| TL | 37.0 | 60.1 | 76.3 | 103.2 | 203.4 | 207.0 | 219.9 | 222.3 | 235.5 | 308.3 |
| MWI | 81.8 | 73.1 | 86.4 | 85.9 | 74.9 | 74.0 | 72.8 | 81.4 | 75.3 | 85.2 |
| HWI | 88.8 | 71.1 | 72.0 | 72.4 | 55.4 | 52.5 | 51.5 | 48.0 | 54.3 | 51.2 |
| MAI | 61.1 | 63.2 | 49.8 | 43.3 | 47.0 | 50.0 | 46.8 | 45.3 | 45.5 | 38.1 |
| ALI | L R | L R | L R | L R | L R | L R | L R | L R | L R | L R |
| I | 153.1 143.4 | 134.4 138.3 | 166.7 166.7 | 208.3 198.7 | 185.8 187.3 | 174.1 178.4 | 200.8 196.6 | 190.3 180.7 | 203.5 202.2 | 204.8 180.6 |
| II | 155.2 153.8 | 142.3 154.2 | 189.4 170.5 | 214.7 214.7 | 196.4 202.4 | 200.0 194.2 | 213.6 202.3 | 201.4 200.0 | 213 0 214.4 | 246.5 237.3 |
| III | 163.6 155.2 | 154.2 156.1 | 200.8 162.9 | 221.2 230.8 | 197.9 213.0 | 198.6 179.9 | 210.7 203.7 | 209.7 197.2 | 218.5 217.1 | 262.7 238.4 |
| IV | 162.2 156.6 | 158.1 158.1 | 193.2 193.2 | 222.8 227.6 | 203.9 208.5 | 192.8 200.0 | 186.7 200.8 | 220.7 213.8 | 219.8 218.5 | 247.7 258.1 |
| AWI | 11.9 | 8.7 | 9.5 | 7.7 | 8.5 | 8.9 | 9.2 | 9.1 | 7.6 | 10.0 |
| ASIn | 5.6–7.0 | 6.3–7.1 | 7.2–7.6 | 6.7–7.4 | 5.7–6.2 | 5.8–6.9 | 5.8–6.5 | 6.9–7.9 | 6.0–6.9 | 6.0–7.6 |
| WDI | 35.0 | 41.3 | 32.6 | 29.9 | 27.0 | 33.1 | 29.8 | 33.1 | 27.8 | 24.2 |
| WF | DCBEA | DCBEA | DCEBA | DCBEA | D = CEBA | DCBEA | CBDAE | DCBEA | DCBEA | DCBEA |
| GiLC | 7 7 | 8 8 | 7 7 | 8 8 | 8 8 | 8 8 | 8 8 | 8 8 | 8 8 | 8 9 |
| EgLI | — | — | — | — | 4.2–5.4* | — | 3.4–3.5* | 16.4 | 4.3–5.8* | 12.7 |
| EgWI | — | — | — | — | 0.9–1.1* | — | 0.6* | 3.4–3.9 | 0.7–0.9* | 2.9–3.2 |
| FuLI | 41.3 | 38.7 | 36.4 | 40.1 | 39.4 | 33.1 | 36.5 | 31.4 | 36.6 | 38.2 |
| FFuI | 22.4 | 22.5 | 25.4 | 19.6 | 24.6 | 19.0 | 20.4 | 14.3 | 24.4 | 24.5 |
| PAI | 83.9 | 79.1 | 94.7 | 89.7 | 80.1 | 79.1 | 87.7 | 80.0 | 76.0 | 92.6 |

*Immature eggs.

TABLE 3. Measurements (mm) and indices of 10 male *Octopus pallidus*.

| | F30855 | F52108 | F30872 | F24453 | F24499 | F52497 | F52087 | F52087 | F52499 | F52500 |
|---|---|---|---|---|---|---|---|---|---|---|
| ML | 43.0 | 54.1 | 54.7 | 56.9 | 60.8 | 64.8 | 69.4 | 89.7 | 98.1 | 105.0 |
| TL | 132.2 | 182.3 | 184.9 | 158.8 | 222.1 | 225.9 | 204.9 | 302.2 | 364.1 | 353.6 |
| MWI | 73.7 | 81.7 | 78.1 | 67.0 | 91.0 | 76.4 | 79.8 | 78.0 | 70.8 | 63.2 |
| HWI | 59.3 | 58.0 | 59.4 | 50.4 | 56.3 | 52.9 | 57.6 | 48.7 | 47.2 | 44.2 |
| MAI | 47.8 | 43.3 | 46.1 | 49.5 | 38.2 | 41.3 | 46.0 | 42.9 | 38.7 | 44.9 |
| ALI | L R | L R | L R | L R | L R | L R | L R | L R | L R | L R |
| I | 186.0 181.4 | 199.6 199.6 | 205.4 200.7 | 165.2 170.5 | 241.8 236.8 | 214.5 220.7 | 194.5 190.2 | 204.0 212.9 | 235.0 234.6 | 200.0 197.1 |
| II | 202.3 193.0 | 203.3 201.5 | 207.5 216.1 | 184.5 181.0 | 248.4 258.2 | 228.4 231.5 | 203.2 191.6 | 211.8 216.3 | 245.6 258.1 | 205.7 211.4 |
| III | 207.0 172.1 | 221.8 184.8 | 216.6 193.2 | 202.1 159.9 | 258.2 218.8 | 223.0 194.4 | 197.4 155.6 | 229.7 190.6 | 256.1 201.6 | 222.9 173.3 |
| IV | 209.3 197.7 | 229.2 231.1 | 217.7 221.6 | 196.8 189.8 | 261.5 241.8 | 242.3 236.1 | 208.9 217.6 | 233.0 230.8 | 242.3 248.4 | 214.3 212.4 |
| AWI | 9.3 | 8.8 | 11.7 | 9.7 | 10.9 | 8.6 | 11.7 | 10.0 | 8.5 | 10.1 |
| ASIn | 5.6–6.0 | 6.7–6.8 | 7.3–9.0 | 5.8–7.2 | 8.9–11.0 | 9.1–10.0 | 7.5–9.1 | 8.8–10.1 | 10.2–11.7 | 11.5–13.5 |
| WDI | 34.4 | 28.0 | 36.3 | 33.0 | 23.9 | 27.7 | 27.2 | 25.4 | 24.1 | 29.9 |
| WF | DCB = EA | DCBEA | DCEBA | DCEBA | DCBEA | DCBEA | DCBEA | DCBEA | DCBEA | DCEBA |
| GiLC | 8 8 | 8 8 | 8 8 | 7 7 | 8 8 | 8 8 | 8 8 | 9 9 | 8 8 | 8 8 |
| HcAI | 172.1 | 184.8 | 193.2 | 159.9 | 218.8 | 194.4 | 155.6 | 190.6 | 201.6 | 173.3 |
| OAI | 83.1 | 83.3 | 89.2 | 79.1 | 84.7 | 83.4 | 78.8 | 83.0 | 78.7 | 77.8 |
| LLI | 4.6 | 6.8 | 4.9 | 7.5 | 15.6 | 10.3 | 8.6 | 9.6 | 8.7 | 12.4 |
| CaLI | 41.2 | 52.9 | 59.6 | 55.9 | 34.3 | 42.2 | 54.8 | 35.1 | 39.0 | 32.3 |
| PLI | 12.6 | 16.3 | 22.9 | 14.1 | 22.7 | 26.5 | 14.8 | 22.5 | 21.9 | 18.2 |
| SpLI | — | — | — | — | 91.3–98.4 | 98.0–118.2 | 42.8* | 82.2–87.1 | 87.0–91.2 | 62.6–71.0 |
| SpWI | — | — | — | — | 2.7–2.8 | 2.7–2.8 | 3.3 | 2.6–2.8 | 2.1–2.2 | 2.8–3.0 |
| SpRI | — | — | — | — | 44.0–47.7 | 34.5–41.9 | 51.2 | 38.5–45.7 | 38.8–52.3 | 39.6–40.9 |
| FuLI | 36.0 | 41.0 | 36.6 | 33.4 | 51.5 | 44.4 | 35.0 | 39.0 | 41.3 | 40.9 |
| FFuI | 27.9 | 23.1 | 10.8 | 19.3 | 30.1 | 21.1 | 19.0 | 26.4 | 30.3 | 23.2 |
| PAI | 90.7 | 101.7 | 91.4 | 77.3 | 102.0 | 71.0 | 79.3 | 98.1 | 77.7 | 73.3 |

*Only one ill-formed spermatophore in Needham's sac; animal apparently just maturing.

TABLE 4. Combined ranges, means and standard deviations of indices of 10 male and 10 female *Octopus pallidus*.

| Index | Range and mean | S.D.(n−1) |
|---|---|---|
| MWI | 67.0– 77.5– 91.0 | 6.8 |
| HWI | 44.2– 57.6– 88.8 | 10.9 |
| MAI | 38.1– 46.4– 63.2 | 6.5 |
| ALI I | 134.4–192.1–241.8 | 25.3 |
| II | 142.3–205.4–258.2 | 27.1 |
| III | 154.2–201.8–262.7 | 28.6 |
| IV | 156.6–213.1–261.5 | 26.3 |
| AWI | 7.6– 9.5– 11.9 | 1.3 |
| ASIn | 5.6– 7.7– 13.5 | 1.9 |
| WDI | 23.9– 30.2– 41.3 | 4.6 |
| HcAI | 155.6–184.4–218.8 | 19.4 |
| OAI | 78.7– 82.1– 89.2 | 3.5 |
| LLI | 8.6– 10.9– 15.6 | 2.7 |
| CaLI | 32.3– 39.6– 54.8 | 8.2 |
| PLI | 12.6– 19.3– 26.5 | 4.7 |
| SpLI | 42.8– 84.5–118.2 | 20.1 |
| SpWI | 2.1– 2.7– 3.3 | 0.2 |
| SpRI | 34.5– 43.2– 52.3 | 5.6 |
| EgLI | 12.7– 14.5– 16.4 | 2.6 |
| EgWI | 2.9– 3.4– 3.9 | 0.4 |
| FuLI | 31.4– 38.5– 51.5 | 4.4 |
| FFuI | 10.8– 22.4– 30.3 | 4.8 |
| PAI | 71.0– 85.3–102.0 | 9.4 |

TABLE 5. Ranges, means and standard deviations of selected characters showing sexual dimorphism in female and male (60–90 mm ML) *Octopus pallidus*.

| | Females (n = 6) | | Males (n = 4) | |
|---|---|---|---|---|
| Character | Range and mean | S.D. (n−1) | Range and mean | S.D. (n−1) |
| ML | 66.2– 73.2– 86.4 | | 60.8– 71.2– 89.7 | |
| ALI III L | 197.9–216.4–262.7 | 24.0 | 197.4–227.1–258.2 | 25.0 |
| III R | 179.9–208.2–238.4 | 19.8 | 155.6–189.9–218.8 | 26.0 |
| ASIn | 5.7– 6.5– 7.9 | 0.7 | 7.5– 9.3– 11.0 | 1.1 |

based his description of *O. pallida* upon a re-examination of Hoyle's type material, and on information provided by Berry (1918).

Cotton (1932), Cotton & Godfrey (1940), Macpherson & Gabriel (1962) and Macpherson (1966) have since briefly described *O. pallidus* from specimens collected in south-eastern Australian waters. Planktonic specimens, attributed to *O. pallidus* by Allan (1945), were collected from south-eastern and eastern Australian waters as far north as Bundaberg, Queensland. As that account apparently indicates a tropical as well as temperate distribution for the species, the identification should be considered with caution. On the basis of large eggs attributed to this species, the identification by Allan (1945) cannot be accepted since the juveniles are demersal not planktonic.

**Octopus pallidus** Hoyle, 1885

*Octopus boscii* var. *pallida* Hoyle, 1885a: 223; 1885b: 97; 1886: 81, pls. 1, 3, fig. 2.

*Octopus boscii*, Brazier (not Lesueur, 1821),

TABLE 6. Comparison of selected characters of *Octopus pallidus* and *O. tetricus*.

| | *O. pallidus* Hoyle | *O. tetricus* Gould |
|---|---|---|
| Size | medium (up to 150 mm ML, 350 mm TL, and to 800 g in weight) | large (up to 160 mm ML, 800 mm TL, and to 3000 g in weight)[1] |
| Arm length | 60–70% of TL | 80–90% of TL[1] |
| Arm formula | IV.III.II.I | III.II.IV.I[2] |
| Web depth | 30% of arm length | 20–25% of arm length[1] |
| Funnel organ | V V shaped | W shaped[2] |
| Gill count | 7–9 lamellae on outer demibranch | 9–10 lamellae on outer demibranch[1] |
| Ligula | medium sized, well developed (LLI 8–16%) | very small, poorly developed (LLI 1.5%)[1] |
| Eggs | large (11–13 mm long), attached singly to substrate | small (2.4 mm long), attached in egg strings to substrate[3] |

[1]Roper *et al.* (1984).
[2]Robson (1929).
[3]Joll (1983).

1892: 3 *(partim);* Pritchard & Gatliff, 1898: 241

*Polypus variolatus,* Berry (not Blainville, 1826), 1918: 278, pls. 79–81, figs. 2, 3, pl. 82, figs. 1–4.

*Octopus pallida,* Robson, 1929: 126, text fig. 38 *(partim);* Cotton, 1932: 545; Cotton & Godfrey, 1940: 449, text figs. 432–435 *(partim);* Macpherson & Gabriel, 1962: 415, text fig. 484 *(partim);* Macpherson, 1966: 241.

## MATERIAL EXAMINED

See Table 1.

## DESCRIPTION

Medium-sized animals with firm consistency (Fig. 1a). Mantle saccular, broadly ovoid (MWI 67.0–*77.5*–91.0); mantle wall thick, muscular. Head wide, but narrower than mantle (HWI 44.2–*57.6*–88.8); demarked from mantle by moderate constriction. Eyes large, but not projecting far above surface of head. Funnel large, stout, bluntly tapered (FuLI 31.4–*38.5*–51.5); free for about half its length (Fig. 1b; FFuI 10.8–*22.4*–30.3). Funnel organ consisting of two closely opposed V-shaped units (Fig. 1c); limbs thick. Mantle aperture wide (PAI 71.0–*85.3*–102.0).

Brachial crown very strong, well developed. Arms short (MAI 38.1–*46.4*–63.2), stout (AWI 7.6–*9.5*–11.9), tapering to fine tips. Arm lengths subequal; arm order usually IV.III.II.I. Suckers biserial, with obvious radial grooves; moderately sized (ASIn females 5.7–*6.5*–7.9, males 7.5–*9.3*–11.0); 10th to 13th suckers usually largest, enlarged on all arms of mature males only.

Web formula usually DCBEA; dorsal and ventral sectors always shallower. Webs shallow (WDI 23.9–*30.2*–41.3); web remnants extend up ventral side of arms for approximately 3/4 of their length. Third right arm of males hectocotylised (Figs. 1d, e); shorter than its opposite number (OAI 78.7–*82.1*–89.2; HcAI 155.6–*184.4*–218.8). Spermatophoral groove well developed, with conspicuous thickening of web membrane. Ligula 8–16% of third right arm length in mature animals; usually recurved orally (LLI 8.6–*10.9*–15.6). Ligula groove long, well marked and deep, with incomplete transverse ridges. Calamus short, acutely pointed (CaLI 32.3–*39.6*–54.8).

Gills possess 7–9 lamellae on outer demibranch, plus the terminal lamella.

Digestive tract typical of the genus (Fig. 2a). Upper beak has short, blunt, curved rostrum; curved crest; large wings; large lateral walls, with posterior margin deeply indented (Fig. 2b). Lower beak has short, blunt rostrum, and short hood; wings have tear shaped darkened areas, lightening towards margins (Fig. 2c). Rostrum, hood, crest and lateral walls, of both upper and lower beaks

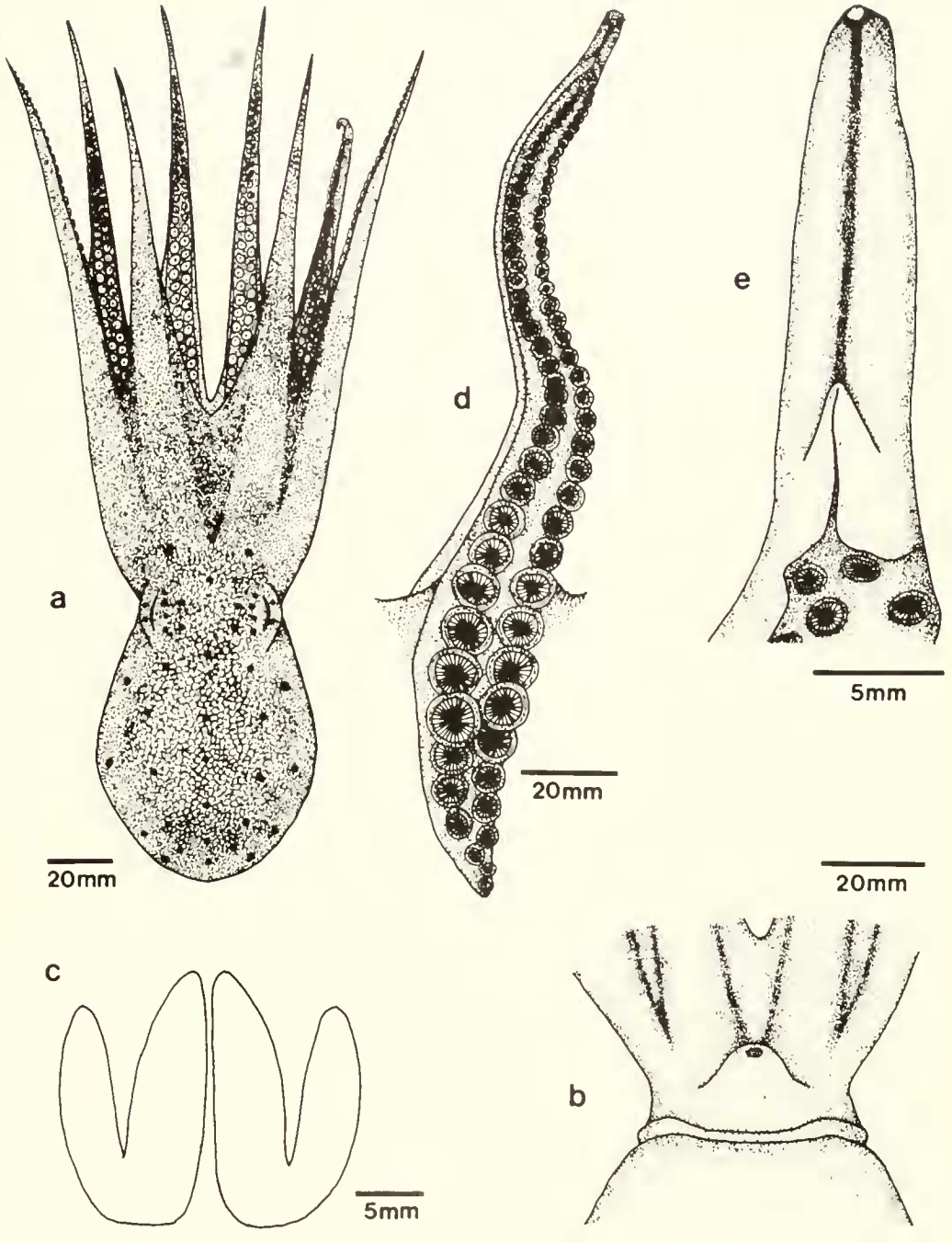


FIG. 1. *Octopus pallidus* Hoyle: **a,** dorsal view of MV F52087, ♂, 89.7 mm ML; **b,** ventral view of mantle opening and funnel, and **c,** funnel organ, of MVF 52505, ♀, 80.8 mm ML; **d,** hectocotylised arm of MVF 52499, 98.1 mm ML; **e,** detail of hectocotylus of MV F52500, 105 0 mm ML.

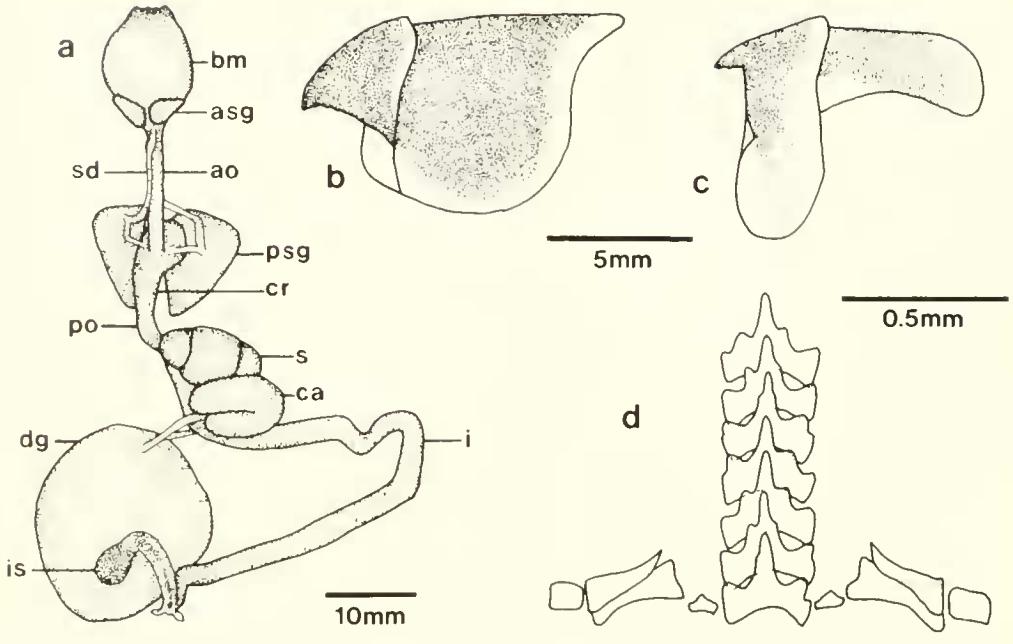


FIG. 2. *Octopus pallidus* Hoyle: **a**, digestive tract of MV F52503, ♂, 54.5 mm ML (*ao*—anterior oesophagus, *asg*—anterior salivary gland, *bm*—buccal mass, *ca*—caecum, *cr*—crop, *dg*—digestive gland, *i*—intestine, *is*—ink sac, *po*—posterior oesophagus, *psg*—posterior salivary gland, *s*—stomach, *sd*—salivary duct); **b**, upper beak, and **c**, lower beak, of MV F52503, ♀, 60.8 mm ML; **d**, radula of MV F52504, ♀, 98 .0 mm ML.

heavily pigmented, dark brown to black; margins of wing, hood, crest and lateral walls of both beaks transparent. Radula typically octopodan (Fig. 2d), with seven transverse rows of teeth. Rhachidian tooth has an asymmetrical seriation of $B_{4-5}$ type, and is slender, with 1–2 small lateral cusps on either side. First lateral teeth small and unicuspidate; second lateral teeth large with long curved base; third lateral teeth long and slightly curved; marginal plates oblong and plain.

Anterior salivary glands small, bordering posterior buccal mass. Posterior salivary glands stout anteriorly, tapering posteriorly, with one salivary duct from each gland running forward independently, then uniting (at a point halfway along the anterior oesophagus) to form single duct running alongside the oesophagus. Duct enters buccal mass dorsal to oesophagus. A second shorter duct runs from each posterior salivary gland to crop. Crop has anterior caecum of about 20% of its length. Posterior oesophagus short. Stomach typically bipartite. Caecum has single loose coil. Two separate ducts connect digestive gland (near the midline) with stomach and caecum. Intestine undifferentiated, although two coils occur midway, but these are not enlarged to form pouches. Ink sac large, lying superficially in groove on ventral face of digestive gland. A short, stout duct connects ink sac with dorsal side of intestine near anus. Anus bears a pair of anal flaps.

Testis posterior in position. Vas deferens long, delicate, tightly coiled, entering spermatophoral gland at proximal end. Spermatophoral gland swollen proximally, with muscular walls, but becoming thin walled towards its junction with the long accessory gland. A short tube connects accessory gland and Needham's sac. Needham's sac long, conical, pointed at apex. There is some variation in the shape of the penis, but generally the organ is long (PLI 12.6–*19.3*–26.5), with a single coiled diverticulum. Genital aperture subterminal, on right side of penis (Figs. 3a, b).

Spermatophores relatively long (SpLI 42.8–*84.5*–118.2) and slender (SpWI 2.1–*2.7*–3.3) (Figs. 3c–f). Oral cap simple, not markedly expanded, with a long cap thread. Ejaculatory apparatus is a tightly coiled tube, which narrows orally, with one coil close to the oral end. Thick, bulbous cement body connects with both oral and aboral ends by narrow necks. Sperm reservoir spirally wound

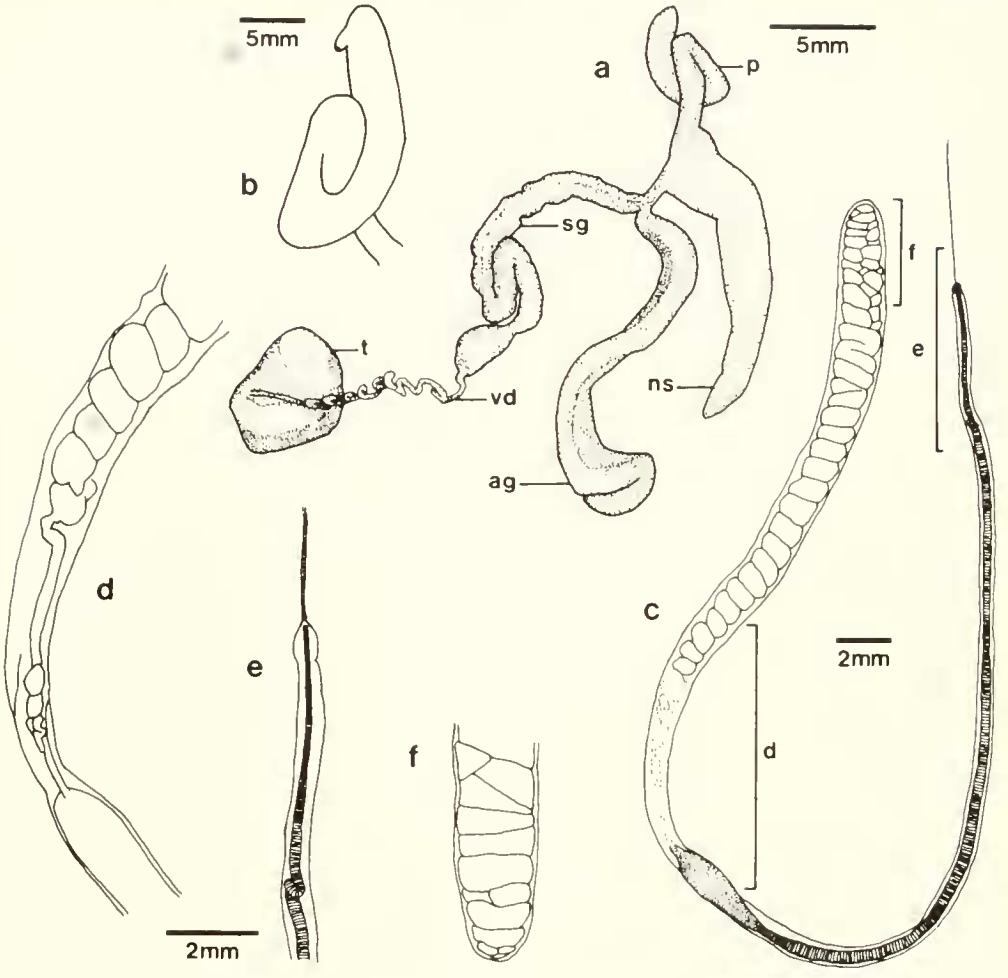


FIG. 3. *Octopus pallidus* Hoyle: **a,** male reproductive organs of MV F52506, 89.4 mm ML (*ag*—accessory gland, *ns*—Needham's sac, *p*—penis, *sg*—spermatophoral gland, *t*—testis, *vd*—vas deferens); **b,** penis of MV F52506, 94.7 mm ML; **c–f,** spermatophore from MV F52507, 117.4 mm ML; **c,** whole spermatophore; **d,** spermatophore midsection, cement body to sperm reservoir; **e,** oral cap and cap thread; **f,** aboral end of sperm reservoir.

with a rounded aboral end; comprises approximately half of the spermatophore length (SpRI 34.5–*43.2*–52.3); forms widest region of spermatophore.

Ovary large, roundly triangular, displacing adjacent organs when mature (Fig. 4a). Proximal oviducts short, straight, attaching to spherical oviductal glands, which are darker in color. Distal oviducts sharply curved, tapering gradually. One female (MV F52502) was observed brooding eggs. Mature eggs large (11–13 mm long, 3–4 mm wide), white, translucent (Fig. 4b; EgLI 12.7–*14.5*–16.4; EgWI 2.9–*3.4*–3.9). Eggs attached singly to substrate by long, thin stalks (6–7 mm long). Egg striation absent.

Integumental sculpture consists of a pattern of coarse, uniformly shaped and closely set epidermal tubercles. These "rosette" shaped tubercles cover both dorsal and ventral surfaces (Fig. 4c). Tubercles reach the largest size on dorsum near base of arms; those on ventral surface are smaller and less prominent. Branched and unbranched papillae present on dorsum. Pattern of papillae on mantle dorsum includes approximately five

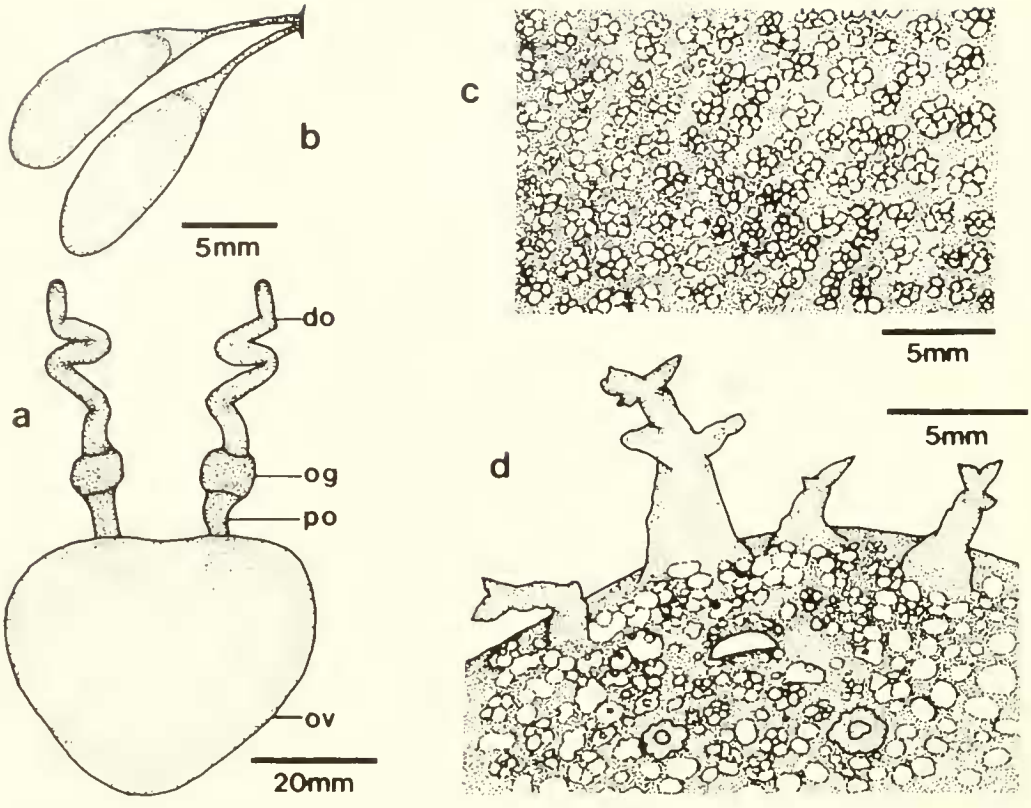


FIG. 4. *Octopus pallidus* Hoyle: **a,** female reproductive organs of MV F52506, 98.8 mm ML (*do*—distal oviduct, *og*— oviductal gland, *ov*—ovary, *po*—proximal oviduct); **b,** mature, laid eggs of MV F52502, 73.5 mm ML; **c,** rosette shaped tubercles on mantle dorsum, and **d,** lateral view of arborescent ocular papillae, of MV F52500, ♂, 105.0 mm ML.

sub-parallel rows of simple, usually unbranched papillae along the mantle length. Each row has 4–6 papillae. Larger arborescent papillae obvious in ocular region (Fig. 4d), with four supraocular and two subocular papillae. Three rows, of two papillae each, lie on the dorsal surface of the web and dorsal pair of arms. Lateral integumentary ridge or fold around mantle circumference absent.

In life, color of resting animals is brown and cream mottled dorsally, paler ventrally; when stimulated, animals become uniformly dark brown to purple. Preserved specimens in isopropyl alcohol reddish brown to orange dorsally, slightly paler ventrally. In both live and preserved specimens, a faint orange stripe is often present along length of dorsal arms. Surface of the raised tubercles usually darker than the background, giving a reticulate pattern. Ocelli absent.

Sexual dimorphism was observed in third right arm length, which is shorter in males, and in sucker diameter, showing enlargement in mature males (see Table 5). Males mature at approximately 50 mm mantle length. Females attain ovarian maturity at about 60 mm mantle length. The largest specimen studied was a male of 147 mm mantle length from off Stanley, Tasmania (MV F52501).

## TYPES

Three syntypes extant, British Museum (Natural History):

*i) BMNH 1889.4.24.19, 1 ♂ (39°10′30″S, 146°37′E, off East Moncoeur Island, Bass Strait, 70 m, sand and shell bottom);*

ii) and iii) BMNH 1889.4.24.20–21, 1♀ and 1 juvenile (36°59′S, 150°20′E, off Twofold Bay, New South Wales, 275m, green mud bottom).

## DISTRIBUTION

*Octopus pallidus* is distributed in the temperate waters of south-eastern Australia, from southern New South Wales to the Great Australian Bight, including Bass Strait and Tasmania (Fig. 5). It is an inshore species, living on sand bottoms, and among sponges and ascidians, at depths from 7 to 275 m.

## DISCUSSION

The taxonomic confusion concerning *O. pallidus* has resulted from the variety of names used for the species. The source of the problem was Hoyle's (1885a) designation of the species as *O. boscii* var. *pallida*.

*O. boscii* Lesueur, 1821, as well as *O. variolatus* Blainville, 1826, were described from Péron's manuscript notes on a specimen from Dorre Island, Shark Bay, Western Australia (Robson, 1929). The descriptions were brief and lacked figures. The type specimen is apparently no longer extant (Robson, 1929). Hoyle (1886) recognised the uncertainty surrounding the name *boscii*. Consequently, he used a specimen, identified by Gray and attributed to *boscii,* when comparing the "Challenger" material. Hoyle (1886) thought the "Challenger" material sufficiently similar to Gray's *boscii* that he named them *O. boscii* var. *pallida*.

Robson (1929) subsequently reidentified Gray's specimen of *boscii* as *O. tetricus* Gould, 1852. So Hoyle (1886) had been attempting to compare a specimen of *O. tetricus* with the *O. pallidus* material from "Challenger." It appears that specimens previously identified as *O. boscii* are now referable to either *O. pallidus* or *O. tetricus*.

Hoyle (1886) and Robson (1929) have remarked upon the similar integumental sculpture of *O. pallidus* and *O. tetricus*, but Robson (1929) mentioned factors that obviously distinguish the two species. Robson (1929), Joll (1983) and Roper, Sweeney & Nauen (1984) have provided details of *O. tetricus* from subtropical south-western Australian waters. Apart from the superficial resemblance of the integumental sculpture, there appear to be few features in common between the two species (see Table 6).

*Octopus pallidus* is a distinctive species endemic to temperate waters of south-eastern Australia. It can be distinguished easily from other sympatric species of *Octopus* and other known species of the genus on the basis of a combination of characters: a broadly ovoid mantle, and stout arms (1-1/2–2 times mantle length), giving the animal a robust appearance; a characteristic pattern of epidermal tubercles, and enlarged papillae over each eye; enlarged suckers on all arms of mature males; a medium-sized ligula (8–16% of third right arm length); large eggs (11–13 mm long), attached singly to the substrate; and 7–9 gill lamellae.

Little is known of the biology of the species. Macpherson & Gabriel (1962) reported that "this species lives in deep water and has been taken in depths of up to 200 fathoms [366 m]. It is often trapped in crayfish pots which it is fond of raiding." Current information, though, indicates that this account was the result of incorrect identification (Winstanley, Potter & Caton, 1983).

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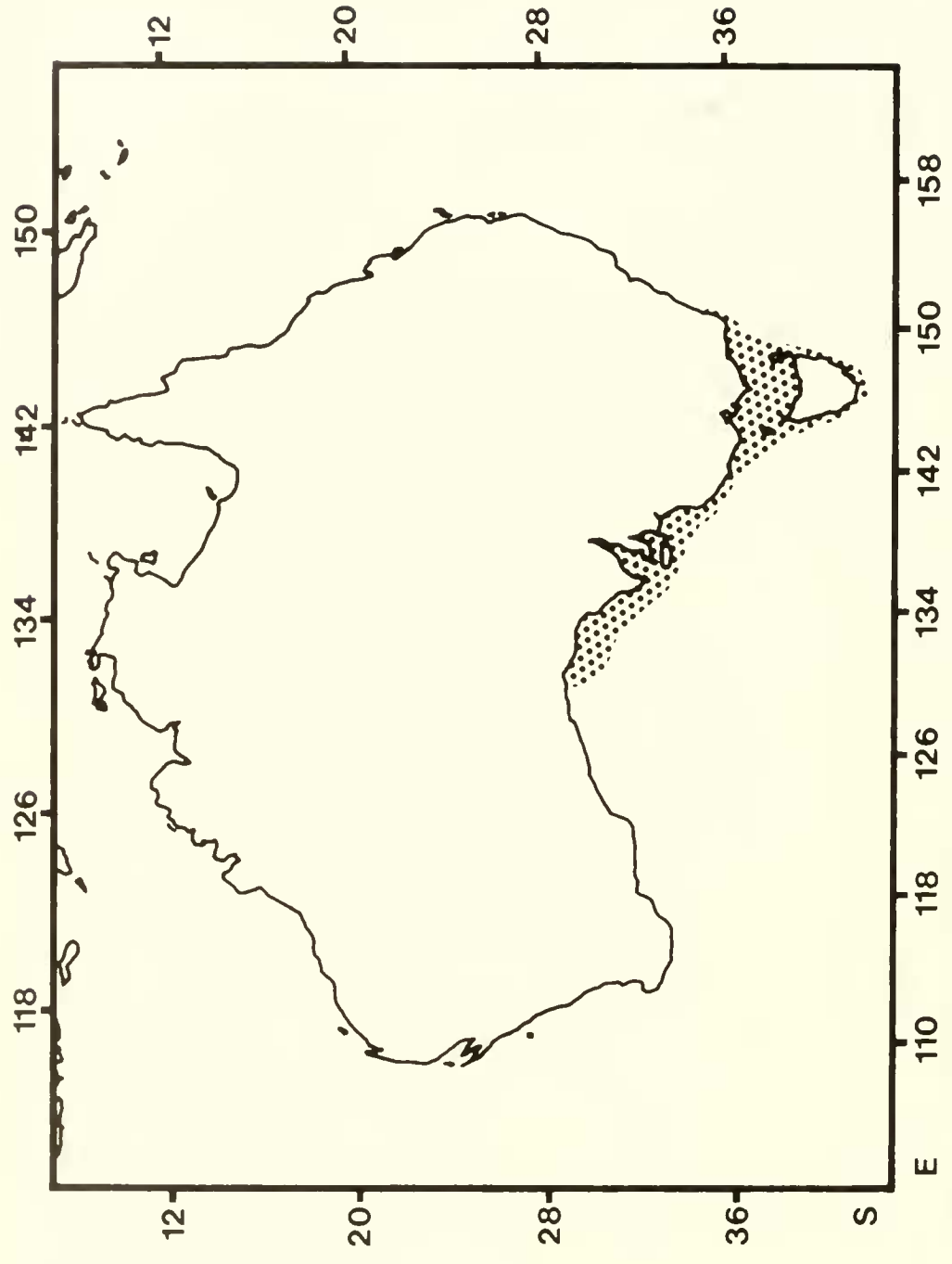


FIG. 5. Geographical distribution of *Octopus pallidus* around the south-eastern coast of Australia.

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